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PATENT SPECIFICATION

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(54) AN APPARATUS FOR CONTINUOUSLY UNWINDING WEB MATERIAL

(71) I, ANTON ROMBOUT, a Dutch Subject, of Secr. Kuitstraat 7, Sonnenberg, Oosterbeek, The Netherlands. do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

The invention relates to an apparatus for continuously unwinding web material wound on cores to form rolls, in particular paper rolls.

It has previously been proposed in such apparatus that the cores be supported at the ends thereof, by tapered members which protrude into the ends of the cores, the tapered members being mounted for free rotation in yokes, the rolls being drivable or deceleratable through driving means adapted to be brought into frictional engagement with the circumference of said rolls, there being provided members for pasting the web end of an almost completely unwound roll to the beginning of the web of a roll to be unwound while maintaining the tension of the web, and for cutting the web behind the place of pasting, both the rolls being held by a roll star and being swivelable into a roll-changing position.

Such an unwinding apparatus has the drawkback that the stationary circumferential driving means which has to bring the new paper roll to be pasted up to an equal speed with the running web, cannot follow said roll during the rotation of the roll star into the pasting position. On arrival at this pasting position, the paper roll is driven by a second stationary circumferential driving means.

During the time in which the paper roll is between the two circumferential driving means, it has insufficient contact with the driving means, and so the deceleration or acceleration function would be uncontrolled. In this phase, therefore, the circumferential drive is switched over to a central drive which drives the rolls by the tapered members. This central drive has the following drawback that if in the central drive phase an emergency stop has to be made, the increasingly higher braking torques on the paper roll resulting from the commonly employed small bore cores, e.g. 76 mm, leads to the core being turned in the paper roll on the tapered members, which usually leads to irreparable damage to the paper roll.

At the ever increasing paper web speeds and greater working widths of modern rotary printing machines, e.g. a 15 m/sec. paper web speed, a 1200 mm roll diameter and an 1800 mm working width, a braking moment of 150 kgm has to be transmitted in 7.5 seconds in case of an emergency stop.

It is an object of the invention to eliminate or at least to reduce these drawbacks.

According to the invention there is provided apparatus for continuously unwinding web material wound on cores to form rolls, in particular paper rolls, comprising tapered members for protruding into the ends of the cores to support the cores, yokes in which said tapered members are mounted for free rotation, driving means adapted to drive the rolls by being brought into frictional engagement with the circumference of said rolls, decelerating means adapted to decelerate the rolls by being brought into frictional engagement with the circumference of said rolls, members for attaching the end of a web which has just been unwound to the beginning of the web of a replacement roll to be unwound while maintaining the tension of the unwound web material, and for cutting the web behind the place of attachment, the yokes being swivelable into a roll changing position, and the driving means being arranged

[*Price 25p*]

to swivel to follow the replacement roll as it is moved into the roll changing position.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings, which illustrate diagrammatically and by way of example an embodiment thereof, and in which:—

Figs. 1 to 4 are part-sectional and partly diagrammatic side-elevations of an apparatus for continuously unwinding web material in four different operational positions;

Fig. 5 is a side view of the apparatus;

Fig. 6 is a cross-section in the same direction as Fig. 5;

Fig. 7 is a cross-section, partly in elevation, of the apparatus on the line VII-VII of Fig. 6; and

Fig. 8 is a cross-section of the lower half, partly in elevation, of the apparatus on the line VIII-VIII of Fig. 6.

In the drawings, like parts are denoted throughout by like reference numerals.

Referring first to Figs. 1 to 4, the apparatus comprises two yokes 1, 2, only one of which, designated 1, is shown. The yokes are slidable and fixable on hollow cylindrical carriers 4, 5 which are circular in cross-section. The carriers are mounted at their ends on circular discs 6, 7, only disc 6 being shown in Figs. 1 and 2 by means of a broken line repreenting a ring gear along its circumference. The discs have a central tap (described later) parallel to driving and supporting rollers to be described hereafter, the taps being mounted for rotation about their centre 3 in a stationary support not shown. Said ring gear is in engagement with the pinion 8 of a so-called inching motor which, through reduction gearing, rotates the discs at a low speed, together with the yokes. The motor and the reduction gearing are not shown in Figs. 1 to 4.

At their free ends the yokes carry tapered supporting members 9, which are conical, and one of which is shown in cross-section in Figs. 1 and 4. Said tapered members are mounted for free rotation in the yoke ends and serve for reaching into the core 10 of a paper roll 11 or 12 in order to carry said rolls.

On the discs 6 are mounted hollow driving rollers 13, 14 by means of shafts, each driving roller being associated with a supporting roller 15, 16. Each supporting roller is mounted on a lever, to be described in detail later on, which is adapted to be swiveled about the centreline of the driving rollers. Around each pair of driving and supporting rollers is an endless friction belt 17, 18 which is always in frictional contact with the circumference of the paper rolls 11, 12 when said rolls are supported by the tapered members.

The operation of the unwinding apparatus is as follows.

Fig. 1 shows the beginning of the unwinding of paper roll 11. The paper web 19 continues on its way via rotatable rollers 20, 21, 22 and a dancer roller 23 situated between rollers 21, 22. A set of draw rollers 24, 25 is provided for conducting the web 19 to a processing machine, such as a printing press, not shown.

The paper roll 12 shown in Fig. 1 is a new roll not yet mounted in the unwinding apparatus.

For maintaining the tension in the paper web at the correct value, the roll 11 is set in rotation at the correct speed by the friction belt 17. The tension in the paper web can be readjusted by the effect of the dancer roller 23 which, through gravity, keeps the parts of the web between the rollers 21 and 22 taut, whereby the roll 11 can be accelerated and decelerated within narrow limits.

After some time the situation shown in Fig. 2 arises, wherein the paper roll 11 is partly unwound and hence has obtained a smaller diameter. The friction belt 17 has been able to follow this reduction in diameter by virtue of the adjustable bearing construction of the rollers 13, 15 and is still in driving contact with the circumference of roll 11.

Meanwhile the paper roll 12 has been mounted between the tapered members of the unwinding apparatus by means of the lifting of two rollers 26, 27 carrying a short endless belt 28, after said roll has been moved above said belt by means of a carriage 29. Through the friction belt 18 the roll 12 is brought into rotation. As the roll 11 is further unwound the inching motor, via pinion 8, effects a slow rotation of the yokes as shown by arrows 32 (Fig. 2), through which the partly unwound paper roll 11 occupies the position of the new roll 12. This position is shown in Fig. 3. Both rolls 11, 12 now rotate at the same peripheral speed, equal to the speed of the paper web beyond the draw rolls 24, 25. When the paper roll 11 has been substantially unwound, the belt 28 is pressed pneumatically against the unwinding roll 11, continuing to follow same until the core with the residual paper has stopped. Shortly before the end of the unwinding paper web, when the paper roll 11 has been unwound substantially to its core 10, swiveling arms 33, which mount a roller 34, press the still tensioned web originating from roll 11 against the roll 12. The web of the roll 12 is secured to the web of the roll 11 by suitable attachment means, e.g. pasting means, such as a plurality of circumferentially extending strips of two-face adhesive tape, by which the web of the roll 12

adheres to the still tensioned web of the roll 11 by the roller 34. When the connection has been made, the remainder of the web originating from roll 11 is cut off by a cutter 35 with an operating handle 36, disposed on the said swiveling arms under roller 34 and swivelable relative to said roller. This is shown in Fig. 4. Pasting and cutting can be effected substantially simultaneously.

Since the roll 12, due to the friction belt 17, already rotates at the correct circumferential speed, the paper web can continue on its way undisturbed.

Referring now to Figs. 5 to 8, it will be appreciated that the view shown in Fig. 5 and the cross-section in Fig. 6 are opposite relative to the schematic Figures 1 to 4. In Fig. 5 the roll 11 has been partly unwound; in Fig. 6 the roll 11, after complete unwinding, has been omitted. The roller 34 effecting pasting of the new web to the expiring web occupies in Fig. 5 an inoperative and in Fig. 6 an operative position. It is also shown how the cutter can be swiveled to its operative position or back about the centreline of the roller 34.

It clearly appears from Fig. 6 how the rollers 13 and 14 are driven. This is done from a central wheel 37 with flattened teeth which is in engagement with an endless toothed belt 38 driving double idle gears 39. Endless toothed belts 40 transmit the rotation to the driving rollers 13 and 14.

The driving rollers 13 and 14 with their associated supporting rollers 15 and 16 are mounted on the ends of two-armed levers 41, 42, the ends of which are pivotally interconnected through pins 43.

Spring means (not shown) act on this pivot point so as to keep the arms 41, 42 as much as possible in alignment, thus maintaining the tension in the friction belts 17, 18 and yet enabling deformation thereof in connection with the reduction in diameter of the paper rolls driven by said belts.

Fig. 5 clearly shows one of the two supports 44, 45 with bearings 46, 47, by which the yokes 1, 2 are supported via cylindrical carriers 4, 5 and the discs 6, 7 via the hollow taps 48, 49 connected therewith (see also Figs. 7 and 8). These bearings are shown in the drawing as plain bearings. There is no objection thereto because the rotation of the taps therein is effected only very slowly, as already earlier explained in connection with the drive of the discs by means of an inching motor.

Inside said hollow taps are mounted hollow shafts 52, 53 by means of roller bearings 50, 51, the said wheels 37 being keyed to each of their inward ends and pinions 54 with flattened teeth on their outward ends. The pinions 54 are brought into rotation via toothed belts 55 through motors (not shown) for driving the friction belts 17, 18.

The positioning of lever arms 41 relative to the other arms can be effected by means of piston rods 57 of pneumatically operating piston and cylinder assemblies, for which purpose said rods 57 are pivoted to lugs 56 on arms 41, and the cylinders 58 of said assemblies are in turn pivoted to supports 59 connected to the discs 6, 7.

Fig. 6 shows the position of the friction belt 18′ against the core 10 of a fully unwound paper roll. The reference numerals are primed.

Through the hollow shaft 52 is passed a compressed air duct 60 for feeding the cylinders 58 and pneumatic taper biasing means not shown. Through the hollow shaft 53 is conducted a threaded spindle which is connected to the yokes 1 and 2 for adjusting the spacing between said yokes in connection with the paper width. Attached to the outward ends of these elements are hand-operated adjusting means not shown.

Shafts 62, 63 are inserted in the cylindrical hollow carriers 4, 5, which have their ends journalled through roller bearings 64 in both discs 6, 7 and each carry outside said bearings a keyed pinion 65.

Said pinions 65 are in engagement with a gear 66 nonrotatably connected to the bearings 46, 47 for the hollow taps 48, 49. During rotation of the discs 6, 7 with the parts connected thereto, the pinions 65 are all forced to roll over the gears 66 at the same rate of rotation.

For driving the paper rolls with the greatest width of 1800 mm, four pairs of friction belts are provided. Fig. 7 shows the two left-hand pairs 17 of the four pairs of belts. Fig. 8 shows the two right-hand pairs 18 of the four pairs of belts.

If narrower paper rolls are used, the yoke distance should be reduced accordingly and one or more pairs of belts can be moved beside the yokes in a manner which will readily occur to those skilled in the art, and will therefore not be described any further.

Supports 67 with rotary rollers 68 are provided on the discs 6, 7 for better guiding of the paper web originating from the lower roll.

WHAT I CLAIM IS:—

1. Apparatus for continuously unwinding web material wound on cores to form rolls, in particular paper rolls, comprising tapered members for protruding into the ends of the cores to support the cores, yokes in which said tapered members are mounted for free rotation, driving means adapted to drive the rolls by being brought into frictional engagement with the circumference of said rolls, decelerating means adapted

to decelerate said rolls by being brought into frictional engagement with the circumference of said rolls, members for attaching the end of a web which has just been unwound to the beginning of the web of a replacement roll to be unwound while maintaining the tension of the unwound web material, and for cutting the web behind the place of attachment, the yokes being swivelable into a roll changing position, and the driving means being arranged to swivel to follow the replacement roll as it is moved into the roll changing position.

2. Apparatus according to claim 1, wherein the driving means comprise endless belts which are lapped around driving rollers and supporting rollers, each driving roller being associated with a supporting roller, the driving and supporting rollers being mounted such that their position relative to each other and relative to the rolls, in use can be varied so that, with maintenance of the tension in the belts, the belts are capable of maintaining contact with the circumference of the roll to be unwound down to a full unwound condition, and of maintaining contact with the circumference of the replacement roll to be unwound.

3. Apparatus according to claims 1 and 2, wherein each driving roller is hollow and is mounted on a shaft which is rotatably mounted with its ends in discs having a central tap parallel to the rollers, said tap being rotatably mounted in a stationary support, said driving means adapted to drive the rolls comprising two-armed levers whose arms are mutually pivotal, the free ends of respective one arms of the two-armed levers carrying the driving rollers and the free ends of respective other arms of the two-armed levers being provided with bearings for the supporting rollers, there being spring means for keeping both arms of the two-armed levers as much as possible in alignment for maintaining the belt tension.

4. Apparatus according to claims 1 to 3, wherein the yokes are mounted so as to be mutually slidable on carriers, and wherein guide means extend through the yokes adjacent their centre and are attached to the discs parallel to the rollers.

5. Apparatus according to claim 4, wherein the yoke carriers are hollow cylinders through each of which projects a shaft which is rotatably mounted in the discs.

6. An unwinding apparatus according to claims 3, 4 and 5, wherein the central tap of each disc is hollow, and through which tap projects a shaft mounted rotatably therein, which shaft at both ends is provided with pinions having teeth adapted to mesh with a toothed belt, one pinion, through such a belt, bringing into rotation the driving rollers, which are provided with similar external teeth, the other pinion, via a second toothed belt, being driven by a motor, each central tap being accommodated rotatably in a stationary core to which is attached a gear wheel which is in engagement with the two pinions and which is keyed to one end of the shaft passed through the cylinders.

7. Apparatus according to any one of claims 3 to 6, wherein there is attached to the circumference of one of the discs a ring gear with external teeth in which engages a pinion of a motor effecting yoke rotation.

8. Apparatus according to claim 3, wherein there is attached to an arm of each lever an ear with which is connected a piston rod of a pneumatically operable piston cylinder assembly varying the position of the level relative to the disc, the cylinder assembly being pivotally mounted on the disc.

9. Apparatus for continuously unwinding web material wound on cores to form rolls, substantially as described herein with reference to, and as illustrated in, the accompanying drawings.

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Sheet 1

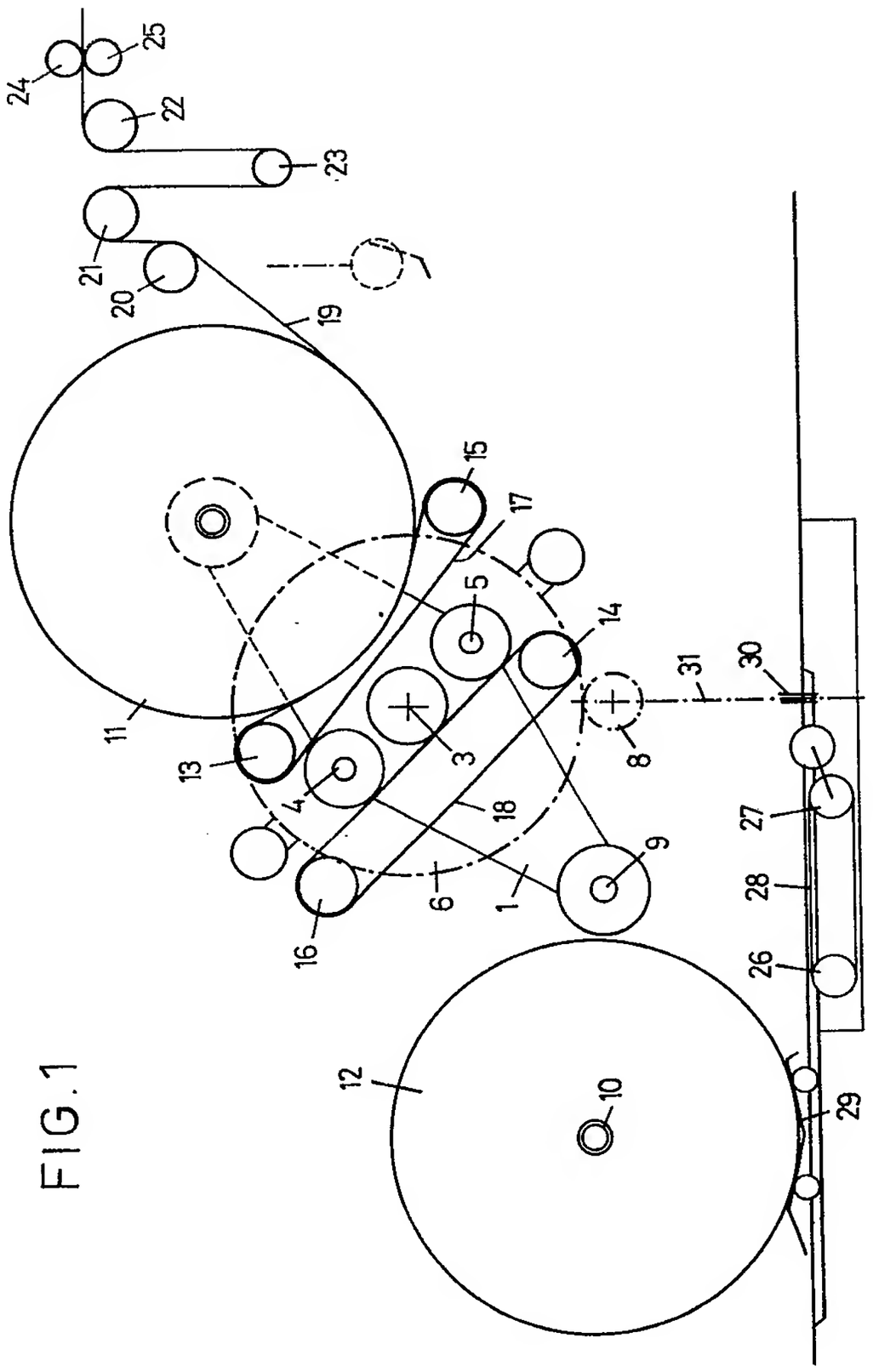

FIG.1

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Sheet 2

FIG.2

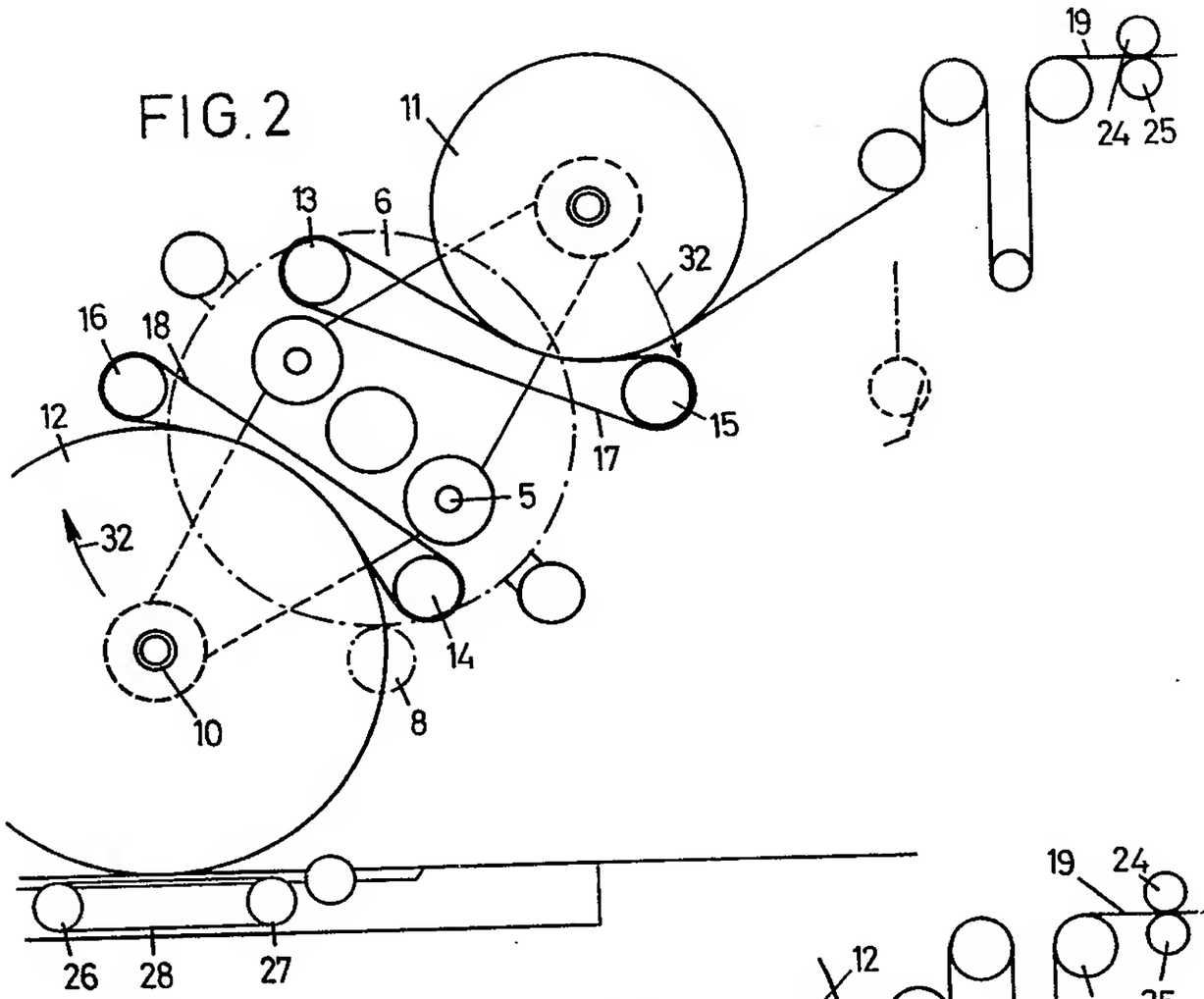
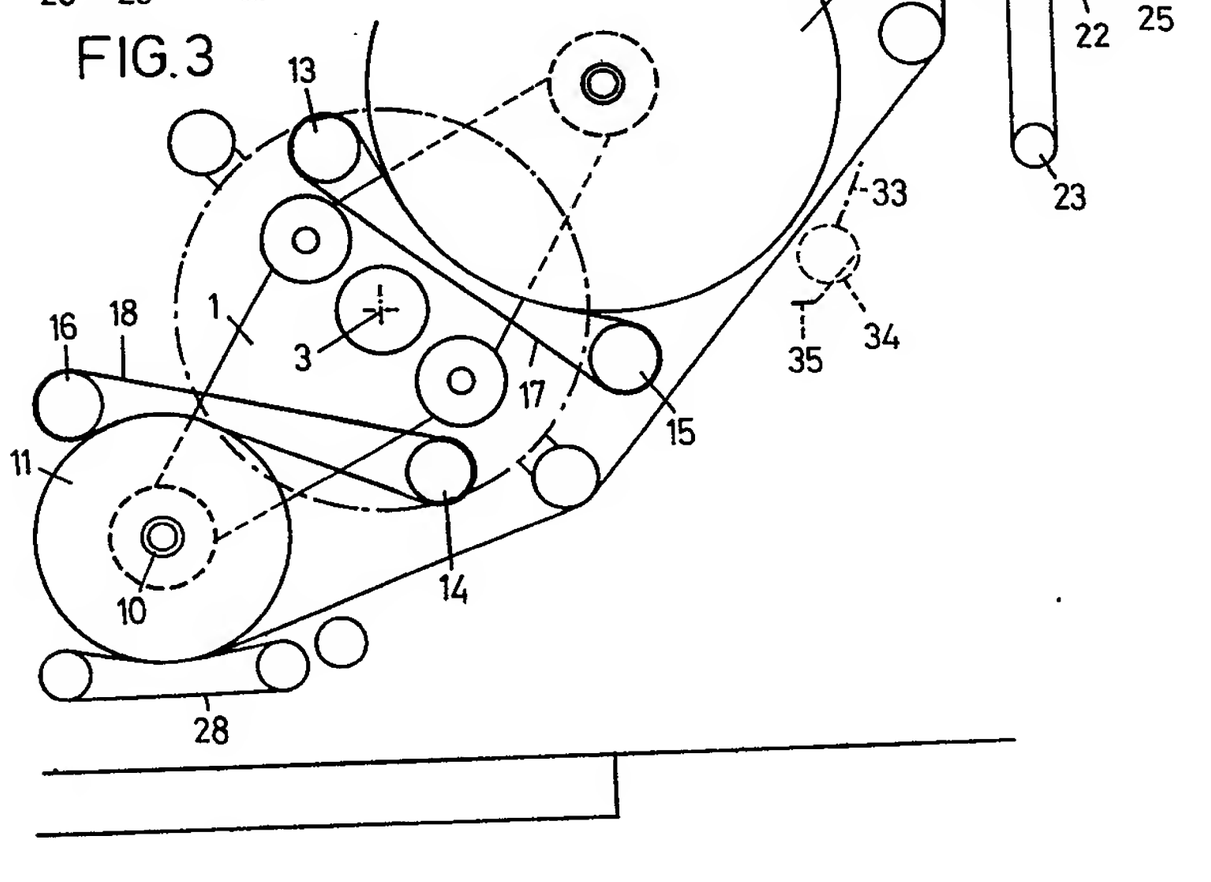


FIG.3



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6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

FIG.4

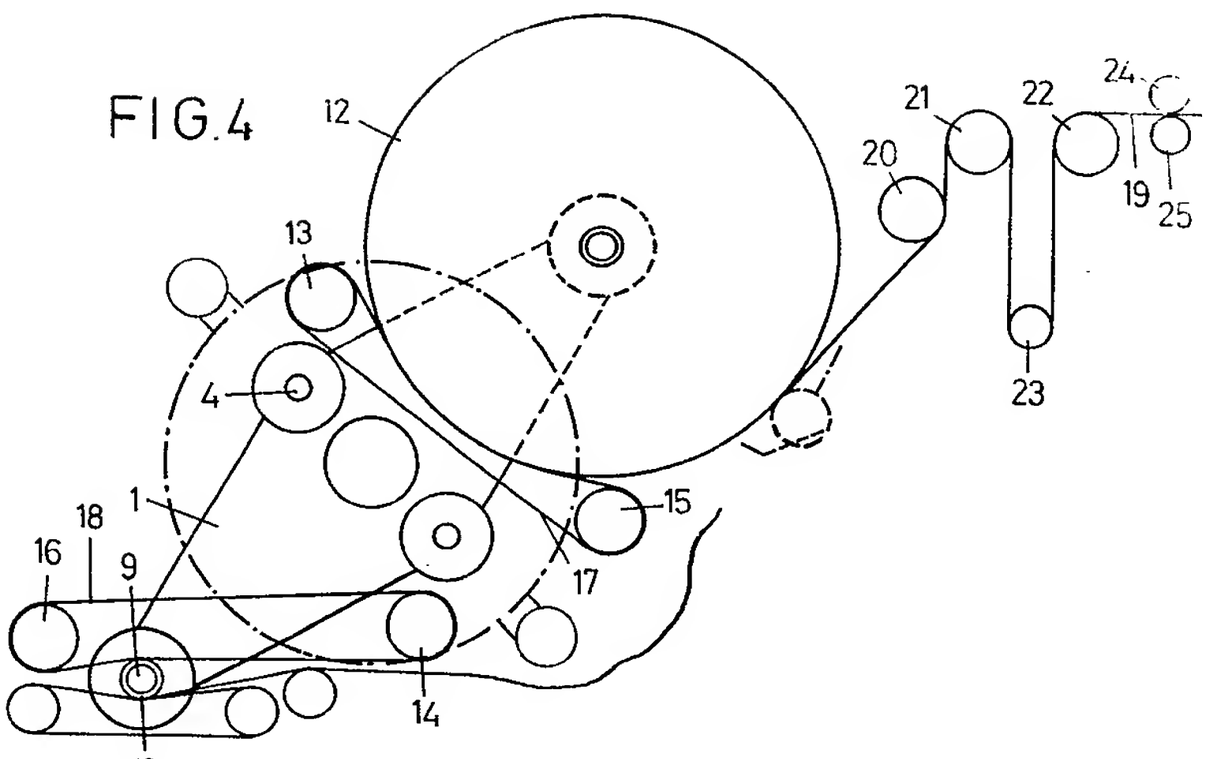
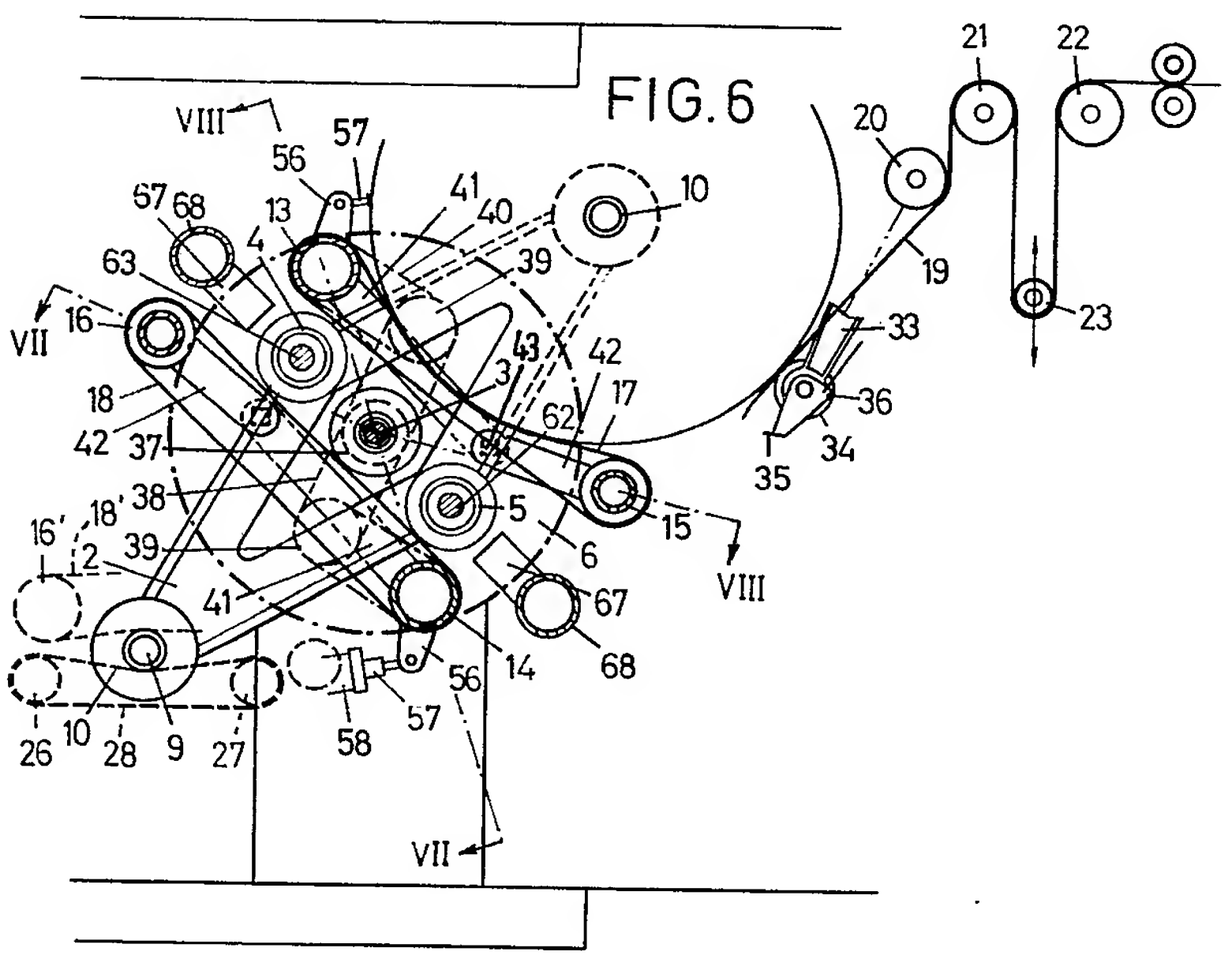


FIG.6



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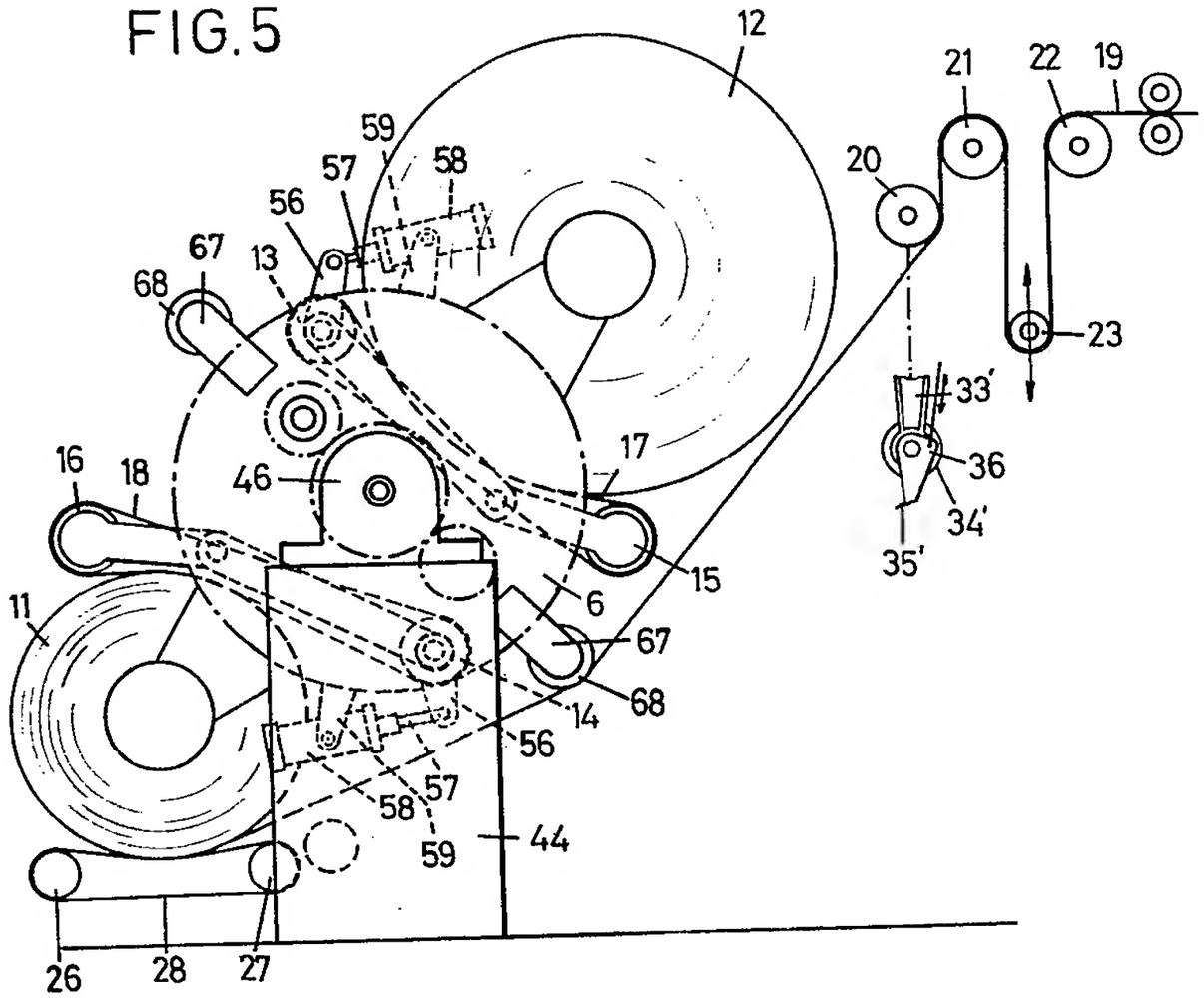
Sheet 4

FIG.5



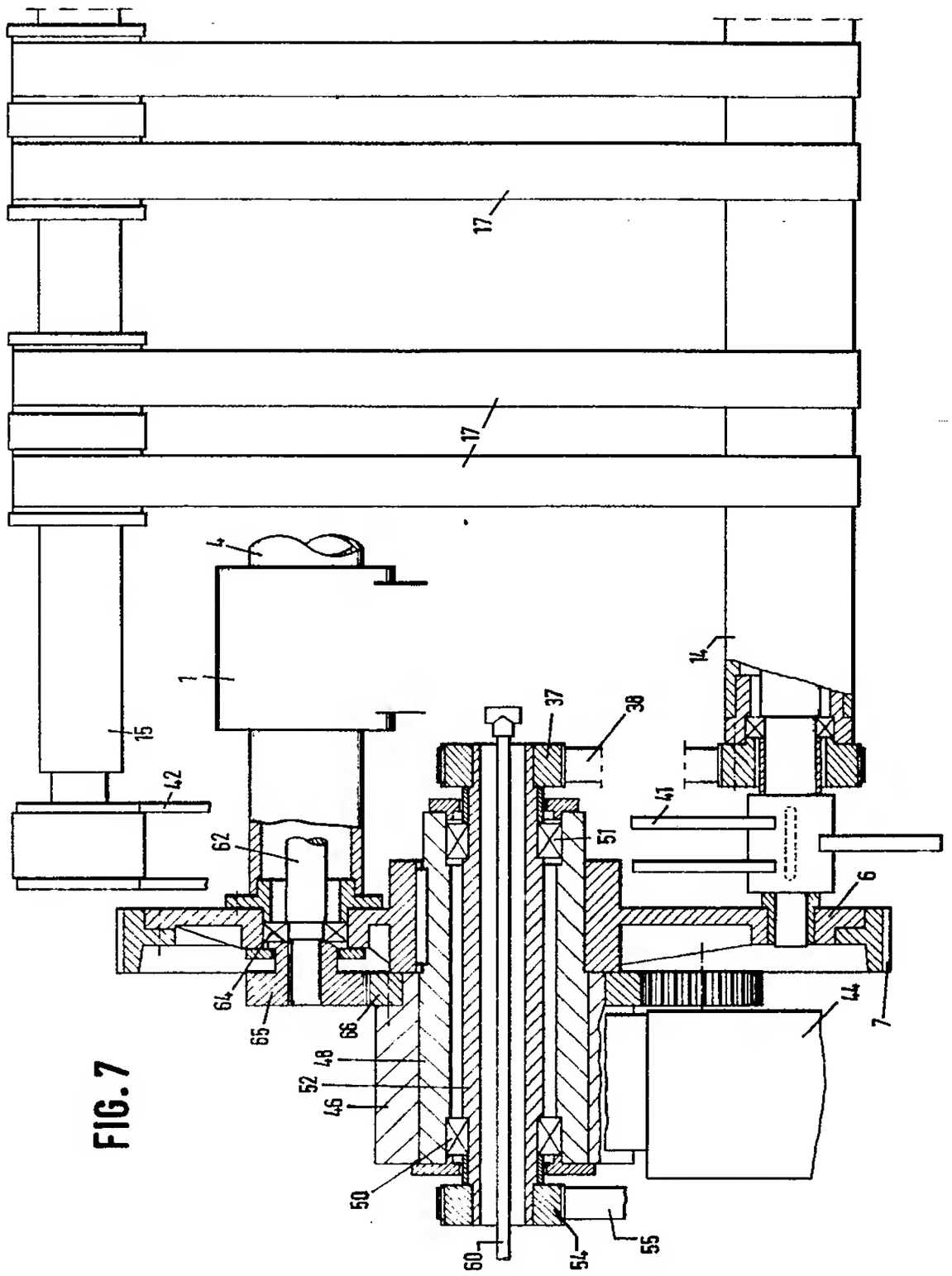


FIG. 7

1375273 COMPLETE SPECIFICATION
6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 6

FIG. 8